

## PATENT ABSTRACTS OF JAPAN

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### (54) INK FOR INK JET PRINTER

#### (57)Abstract:

PROBLEM TO BE SOLVED: To obtain ink for ink jet printers by including a superfine particulate specific yellow pigment and dispersing in a uniform and stable way.

SOLUTION: This ink is obtained by compounding with and dispersing a superfine pigment of isoindolinone-based color index No. pigment yellow-109 or condensed azo-based color index No. pigment yellow-128 as a superfine specific yellow pigment, a polyoxyethylenealkyl or an alkylphenylether sulfate, a polyoxyethylenealkyl or an alkylallylether phosphate as a dispersing agent, and water or a mixture of water and a water-soluble organic solvent.

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**CLAIMS**

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[Claim(s)]

[Claim 1] Ink for ink jet printers characterized by having blended three persons of the mixed liquor of the water-soluble organic solvent with the super-particle pigment of 0.2 micrometers or less of mean particle diameters which are the Color Index number pigment yellow 109 of an isoindolinone system, or the Color Index number pigment yellow 128 of a condensation azo system, and the water or water which is the polyoxyethylene alkyl or alkylphenyl ethereal-sulfate ester salt which is a dispersant, a polyoxyethylene alkyl or alkyl aryl ether phosphate, and a dispersion-medium object at least, and distributing.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

**[0001]**

**[Industrial Application]** The ink for ink jet printers is the field of the invention of this invention.

**[0002]**

**[Description of the Prior Art]** The ink for ink jet printers using a color (following jet ink and abbreviated name) has a difficulty in lightfastness or water resistance, although printed matter is minute and is a clear color. If a pigment is used instead of a color, although it excels in lightfastness or water resistance, reservation of a definition, visibility, and distributed stability is difficult. Various improvement efforts, such as selection, atomization, stable decentralization, etc. of the pigment of a clear color, are performed with light-proof [ quantity ] and quantity water resistance, and the result of improvement has become accepting in black, red, and blue. However, it is in a state with a still inadequate yellow pigment. In the point of the microsome of light-proof [ quantity ] and quantity water resistance which is the basic requirements of the pigment for jet ink, the yellow pigment is inferior to other black, red, and blue pigment. In color printing, since neutral colors are combination of a fundamental color, if only yellow is inferior, minute clear printing will be difficult and color tone change will be accepted by aging. Such stable distribution becomes difficult that a pigment is atomized. If stable differential powder is not made, it condenses, and turns big and rough, nozzle plugging of a printer happens, and a pigment particle stops making the business as jet ink. Furthermore, stable distribution in jet ink with required being low viscosity is difficult. The jet ink of a yellow pigment is in a still dissatisfied state by such order.

**[0003]**

**[Problem(s) to be Solved by the Invention]** this invention is excellent in light-fast water resistance, and let it be a technical problem to develop the jet ink of the yellow pigment currently distributed uniformly [ the pigment of a super-particle and a clear color ] in a distributed medium, and stably.

**[0004]**

**[Means for Solving the Problem]** While this invention is excellent in the light-fast water resistance suitable for jet ink and chooses the pigment of a super-particle and a clear color, it chooses the dispersant in which is made to distribute uniformly and stably and it deals into a distributed medium, finds out the optimal composition out of both combination further, and expects technical-problem solution of the jet ink of a yellow pigment.

**[0005]** A use field is expanding an ink jet printer on many aspects of affairs of large-scale industrial activity from an individual life. If there is the so-called ink of a fundamental color, and the three primary colors and four black colors, by changing the discharge quantity of the ink from the nozzle of each color, the rate of a compounding ratio of ink will change and the color of hope will be acquired. The discharge quantity of each nozzle is controlled by KOMPITA. Multicolored printing is possible at a stretch at the print head which is the aggregate of a detailed nozzle. This enables high-speed printing or high efficiency printing. Moreover, easy alteration, i.e., the alteration of the main part of a printing machine, of expanding the movable range of a print head is made into the minimum, and it can respond also to large area printing. It is also predominant to

use the ink of the drainage system which there is not or can be made into the minimum which is environmental pollution.

[0006] It is each color, and the color of a clear color is already developed, practical use is widely presented with it, and jet ink is also used. Since a color is used in solution, the homogeneity of concentration is ideal. Therefore, minute printing on the level which can reach the machine precision of a printing machine is possible. However, a color molecule has the inadequate resistance over the chemical of light, oxygen, water, or others, and the fault which deteriorates and fades with time is under those irradiation / contact. That is, the so-called endurance of ink or printed matter is dissatisfied.

[0007] On the other hand, although excelled in endurance like point \*\*, clear \*\*\*\* of a pigment is dissatisfied, since it is insoluble in water, use by the dispersed system is not avoided but it has various difficulties. Although a more desirable amorphous pigment with few [ very small moreover ] crystal ratios should have [ clear \*\*\*\* ] expensive crystal grain, manufacture is difficult, it belongs to the field of advanced know-how, and acquisition in a commercial scene is unexpectedly as difficult as high cost conjointly.

[0008] It is the universal demand to ink for minute printing to be possible. Although the super-atomization of a pigment is required, neither by the kind of pigment, nor its process, difficulty does not exist in atomization and it can necessarily super-atomize with any pigments. Even if a big and rough particle causes nozzle plugging and passes a nozzle, it is a serious disturbance factor of minute printing.

[0009] Since a pigment is un-water-soluble, as drainage system ink, it is a dispersed system. It is necessary to make stability distribute a very fine particle for a long period of time, while it has been detailed. It is easy to form condensation and a big and rough particle, so that a particulate material is detailed, and uniform and stable distribution becomes difficult. Moreover, in an ink jet, since ink is required to be low viscosity, as compared with the ink in other print processes which are high viscosity, the distribution exists under a much more difficult condition.

[0010] Although the endurance of a pigment is in desirable level generally, a difference has it by molecular species. It is a problem whether lightfastness is secured or not, although water resistance etc. is enough and it is satisfactory as jet ink. When the dark color coloring paper in various yellow pigments compared lightfastness, the result of the 1st table was obtained. The lightfastness of front Naka is evaluation to the 8th best class from the 1st class with the worst change in color by exposure. The molecular species of a pigment is the classification by a pigment-content child's basic skeletal structure, and the same skeletal structure also indicated the case of a substituent or a substitution position where it differed. Light-fast level's differing, when molecular species's differs from the pigment of the same yellow system, and the molecular species of a same system of lightfastness being different are also clear if a substituent differs from a substitution position.

第1表：顔料の耐光性

顔料分子種	顔料 (C. I. 番号)	耐光性(級)
フラバントロン系	ピグメントイエロー24	5
モノアゾ系	ピグメントイエロー73	7
	ピグメントイエロー75	6
ジスアゾ系	ピグメントイエロー12	5
	ピグメントイエロー16	7
	ピグメントイエロー55	6
縮合アゾ系	ピグメントイエロー93	7
	ピグメントイエロー128	8
イソインドリノン系	ピグメントイエロー109	8
	ピグメントイエロー110	8
アントラキノン系	ピグメントイエロー99	8
	ピグメントイエロー108	8

[0011] Although it changes with exposure times etc. in the wavelength and the on-the-strength pan of an environmental condition and exposure light with which printed matter encounters, when the dissatisfaction in color system jet ink is canceled and the level of the lightfastness required of the yellow pigment for jet ink takes the lightfastness of the pigment of other colors into consideration, it is the 8th class desirably the 7th more than class. Both the lightfastness of the pigment red 122 of the PIKUMENTO blue 15:3 incidentally used often as blue pigment with another color pigment, for example or red pigments is the 8th class, and the number of lightfastness of black carbon black is also eight.

[0012] Only by the endurance which makes lightfastness the start being excellent, the pigment for jet ink is dissatisfied. It is important as an ultrafine particle to distribute uniformly and stably in ink so that printer nozzle plugging moreover may not be started so that minute printing may be possible.

[0013] Since the primary non-fixed form particle in the state where the overly detailed single crystal was combined with the amorphous object is an aggregated particle which carried out condensation combination further, the pigment with which a pigment is actually manufactured although the stable crystal structure changes with kinds of the molecule is a non-fixed form particle. With reaction conditions of pigment composition, an aggregated particle may condense the size of a particle further according to subsequent ejection conditions again, and it changes variously. If it takes out especially and stabilization, color tone regulation, etc. of heat treatment and other pigments are sometimes processed, condensation will progress in many cases. Therefore, the obtained pigment carries out pulverization atomization of this, and usually considers as the pigment for jet ink. The particle diameter of a pigment is measured with for example, laser diffraction or a scanning electron microscope. The diameter of a printer nozzle and especially the mean particle diameter of the demand of minute printing to a pigment have desirable 1 micrometer or less 5 micrometers or less.

[0014] Since intermolecular force changes with pigment molecular species, the difficulty of atomization changes with kinds of pigment. Although neither the condensation azo system pigment nor the isoindolinone system pigment was necessarily easy and ultrafine-particle-izing was possible when this invention persons considered ultrafine particle-ization which goes back to a pigment composition reaction for example, ultrafine particle-ization should be satisfied [ with the metal-containing pigment of an anthraquinone system or others ] of-ization was not completed.

[0015] Fundamentally, the color tone of a yellow pigment becomes settled by molecular species, and changes with molecular species. Color tones differ delicately on manufacture conditions also with the same pigment. Even if it calls it yellow, the yellow which redness cut, the yellow which green cut are various. Although it is desirable that it is a clear color, simultaneously with it, the quality of neutral-colors tone coloring is asked by preparation with other primary colors. In a yellow pigment, the Color Index number pigment yellow 109 of an isoindolinone system or the Color Index number pigment yellow 128 of a condensation azo system is suitable also not only from lightfastness but this viewpoint.

[0016] In the yellow jet ink of this invention, a dispersion-medium object is the mixed liquor of water or water, and the water-soluble organic solvent. Although it is also possible to make uniform and stable jet ink from use of only water, it is the purpose which prevents improvement in the dispersion power force, and the blinding of the nozzle by dryness, and addition is indispensable in the water-soluble organic solvent little as a moisturizer.

[0017] If the water-soluble organic solvent in this invention is an amount [ at least ] fewer than water, it is an organic solvent which may be dissolved at water and an arbitrary rate. as the example — ethylene glycol, a diethylene glycol, and a propylene glycol — glycol ethers, such as alkanolamines, such as polyhydric-alcohol [ such as the polyethylene glycol or polypropylene glycol of low molecular weight, and a glycerol, ], monoethanolamine, diethanolamine, N, and N-dimethylethanolamine and a morpholine, an ethylene glycol monomethyl ether, an ethylene glycol wood ether, the diethylene-glycol monomethyl ether, and tripropylene glycol monomethyl ether, are mentioned comparatively Volatility is low in these, and the way is more desirable although

most odors cannot be found.

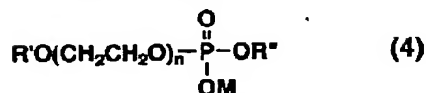
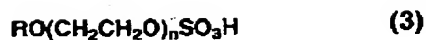
[0018] Generally, use of a dispersant is indispensable in order to make the dispersion-medium object of a drainage system distribute a pigment. Various kinds of dispersants are proposed from the former, and they are divided roughly into an anion activator, Nonion activator, cation activator, amphoteric activator, and macromolecule system dispersant. As an anion activator, a fatty-acid salt, alkylbenzene sulfonates, an alkyl-sulfuric-acid ester salt, alkyl phosphate, an alkyl sulfo succinic-acid salt, a polyoxyethylene-alkyl-ether sulfate salt, polyoxyethylene alkyl ether phosphate, a naphthalene sulfonic-acid formalin condensation product, alpha-olefin sulfonate, etc. are the example. As an example of a Nonion activator, polyoxyethylene alkyl ether, polyoxyethylene alkyl aryl ether, polyoxyethylene alkylamine, oxyethylene / oxypropylene block copolymer, a sorbitan fatty acid ester, polyoxyethylene sorbitol fatty acid ester, polyoxyethylene fatty acid ester, a glycerine fatty acid ester, etc. are mentioned. As an example of a cation activator and an amphoteric activator, alkylamines, quaternary ammonium salts, alkyl betaines, and AMINOKI sides are mentioned. As a macromolecule system dispersant, a polyacrylic acid, styrene / acrylic-acid copolymer, styrene / maleic-anhydride copolymer, styrene / methacrylic-acid copolymer, styrene / acrylic acid / methacrylic-acid copolymer, styrene / maleic anhydrides / methacrylic-acid copolymers, or these salts are mentioned.

[0019] this invention persons — the original mean-particle-diameter 1.0–0.6micrometer pigment yellow 109 — said — the result which should be satisfied was not obtained although the various above-mentioned dispersants were comprehensively examined in making a drainage system medium distribute 128 Although the case where the distribution between short days was securable was accepted by the kind and the amount of the dispersant used, the distributed state stable to a long period of time was not securable. The dispersant applicable to this was a polyoxyethylene alkyl or an alkylphenyl ethereal-sulfate ester salt, a BORIOKISHI ethylene alkyl, or alkyl aryl ether phosphate. However, distribution between short days was not completed in the dispersant of the other varieties, either.

[0020] this invention persons — the pigment yellow 109 — said — as a result of pursuing distribution of 128 further, stable distribution found out the bird clapper possible against the common idea that distribution becomes difficult, by super-atomizing a pigment to 0.2 micrometers or less of mean particle diameters in this case, and the pigment reached this invention, so that it was made detailed Although the reason is not yet clear, while the surface energy of a pigment increases by atomization and it becomes easy to condense The Brownian motion of a pigment particle becoming active and condensing by super-atomization, also sets being barred and a deer about the pigment of this invention, and the combination of a dispersion-medium object. Only a polyoxyethylene alkyl or an alkylphenyl ethereal-sulfate ester salt, a polyoxyethylene alkyl, or alkyl aryl ether phosphate acts effectively as a dispersant. The energy balance of a dispersed system can take a state advantageous to distribution, and is considered that the state in which stable distribution is possible is realized. The conditions which can be distributed stable were not able to be found out in the activators or macromolecule system dispersants other than the above.

[0021] the yellow pigment pigment yellow 109 which is the important requirements for composition of the above thing to this invention — said — the mean particle diameter of 128 is 0.2 micrometers or less Although stable prolonged distribution is comparatively possible even for about 0.5 micrometers even of mean particle diameters, there is misgiving practically. Stable distribution of a long period of time [ be / 0.2 micrometers or less / a mean particle diameter ] is possible. Although 0% of the content of the big and rough particle to which a particle diameter exceeds 1 micrometer is desirable, if it is 1 micrometer or less of maximum droplet sizes, about several% of existence is permitted.

[0022] The dispersant which are other important requirements for composition in this invention is the polyoxyethylene alkyl or alkylphenyl ethereal-sulfate ester salt (3) expressed with the following general formula, a polyoxyethylene alkyl, or alkyl aryl ether phosphate (4).



however, R — an or more 4 carbon number [ or less 20 ] alkyl or alkylphenyl, and R' — an alkyl or alkyl aryl, and R'' — H or R (CH<sub>2</sub>CH<sub>2</sub>O) — four or more positive numbers [ 100 or less ] and M to which n and n express the average degree of polymerization of an oxyethylene machine are bases, such as ammonium, an amine, or alkali metal

[0023] The alkyl group of a dispersant is a straight chain or an or more 4 carbon number [ or less 20 ] branched alkyl group, and an octyl, a nonyl, a dodecyl, especially a hexadecyl machine, etc. are desirable. The alkylphenyl machine of a dispersant is or more 4 carbon number [ which has a straight chain or the branched alkyl group as a substituent / or less 20 ] alkylphenyl, and an octyl phenyl, a nonylphenyl, especially a dodecyl phenyl group, etc. are desirable. It is the positive number not more than more than average-degree-of-polymerization n4 100 of an oxyethylene machine, and 50 especially or less [ 5 or more ] are desirable. Especially an amine is desirable although Base M is ammonium, an amine, or alkali metal. the time of the dispersant of this invention filling all the above conventions — for the first time — the pigment yellow 109 — said — it functions as a dispersant of 128 Although the dispersant of varieties was proposed for pigments, when the kind and character of a pigment were specified, it became clear that a suitable dispersant will not be found easily but will be localized to a certain narrow range.

[0024] The pigment chosen as mentioned above, a dispersant, water, and a hydrophilic solvent are used for a compounding ratio, choosing so that many request properties of ink, such as the distributed stability of a pigment and viscosity of ink, may be satisfied.

[0025] Although which concentration is sufficient as long as the operating rate of the pigment used in the jet ink of this invention is concentration which gives sufficient coloring concentration for the recorded body The rate which generally occupies 1 to 10 % of the weight in an ink constituent from various viewpoints, such as a stable operation of a printer nozzle and the preservation stability of ink, is desirable.

[0026] Although the amount of the dispersant used in the jet ink of this invention changes also with the kind of pigment, grain size, or request viscosity of jet ink and cannot generally be specified, it is desirable to use it at a rate of the 10 to 100 weight section generally to the pigment 100 weight section.

[0027] Although the mixed stock of water or water, and a hydrophilic solvent is used for the solvent object in the jet ink of this invention, as for the operating rate of the hydrophilic solvent in a mixed stock, it is desirable that they are below the 100 weight sections generally to the water 100 weight section.

[0028] It is possible to add additives of \*\*, such as the additive which is the field concerned and is already known, for example, antiseptics etc., by this invention if needed furthermore. Since a dispersant is an anion system, in order to make it stability especially, it is necessary to make it about 9 by addition of pH regulator.

[0029] The jet ink of this invention consists of an above-mentioned constituent and the above-mentioned blending ratio of coal, and various kinds of methods can be used for it in this manufacture. For example, after blending the various above-mentioned components and carrying out mixed grinding of the pigment for this conventionally by well-known dispersers, such as a ball mill, a Sand-grinder mill, a speed line mill, and a roll mill, the physical-properties value of concentration, grain size, and others can be adjusted, a big and rough particle can be removed by filtration, centrifugal separation, etc., and ink can be obtained.

[0030] Hereafter, an example is given and explained about this invention. In addition, the section is the weight section in a sentence. The lightfastness of a pigment applied ink in the paper, and exposed and judged it in xenon fade meter according to JISK5701. The grain size and particle size distribution of a pigment diluted ink with the liquid of a pigment to which a distributed change of state is not carried out, and measured it in the laser diffraction formula particle-size-

distribution measuring device. The distributed stability of the pigment in ink measured change of the particle size distribution after 7 cycle \*\*\*\*\*, and judged the thermal cycling test which puts separately change of particle size distribution in the meantime, and ink at -20 degrees C by 60 degrees C for 12 hours for 12 hours after putting ink for three months at a room temperature.

[0031] (Example 1) The mean particle diameter manufactured the yellow pigment pigment yellow 109 which is 0.2 micrometers, carried out distributed processing of the 50 sections, the polyoxyethylene oleyl ethereal-sulfate ester salt (tradename : high tenor 18E, Dai-Ichi Kogyo Seiyaku make) 10 section which is a dispersant and the diethylene-glycol 20 section, the water 160 section, and the antiseptics (tradename : pro KUSERU GXL, product made from ICI) 2 section with the ball mill, and obtained the dispersion liquid of a yellow pigment. After adding the glycerol 150 section, the diethylene-glycol 80 section, the monoethanolamine 2 section, and the water 526 section to these dispersion liquid and carrying out mixed stirring, it applied to centrifugal separation, the big and rough particle was removed, and the yellow jet ink whose pigment concentration is 5.0% was obtained. The 8th class and the pigment particle in ink are maintaining the original mean particle diameter, and minute printing of the lightfastness of ink in the paper was favorably completed with the ink jet printer. Condensation of a pigment was not accepted but minute printing also of after the gentle placement for three months which sees the distributed stability of a pigment, and a thermal cycling test was completed favorably. In addition, both the lightfastness of the neutral colors which carried out equivalent mixture of this yellow ink, the ink of the blue-pigment PIKUMENTO blue 15:3, or the ink of the red-pigments pigment red 122 was the 8th class.

[0032] (Example 1 of comparison) Although it replaced with the pigment of an example 1 and the mean particle diameter manufactured ink by the same method as an example 1 using the yellow pigment pigment yellow 109 which is 1.0 micrometers, sedimentation of a pigment was accepted by the gentle placement on the 1st, and sedimentation advanced after that. Although it returned to the uniform distribution state by stirring, when put, sedimentation of a pigment took place again.

[0033] (Example 2 of comparison) Although ink was manufactured by the same method as an example 1, using a sorbitan oleate (tradename : SORUGEN 40, Dai-Ichi Kogyo Seiyaku make) as a dispersant replaced with the dispersant of an example 1, condensation of a pigment took place by gentle placement or the thermal cycling test, and favorable printing in this ink was not completed.

[0034] (Example 2) The mean particle diameter manufactured the yellow pigment pigment yellow 109 which is 0.1 micrometers, carried out distributed processing of the 50 sections, the polyoxyethylene nonylphenyl ether phosphoric ester (tradename : ply surfboard A212E, Dai-Ichi Kogyo Seiyaku make) 10 section which is a dispersant and the diethylene-glycol 20 section, the water 160 section, and the antiseptics (tradename : pro KUSERU GXL, product made from ICI) 2 section with the ball mill, and obtained the dispersion liquid of a yellow pigment. After adding the glycerol 150 section, the diethylene-glycol 80 section, the diethanolamine 2 section, and the water 526 section to these dispersion liquid and carrying out mixed stirring, it applied to centrifugal separation, the big and rough particle was removed, and the yellow jet ink whose pigment concentration is 5.0% was obtained. The 8th class and the pigment particle in ink are maintaining the original mean particle diameter, and minute printing of the lightfastness of ink in the paper was favorably completed with the ink jet printer. Condensation of a pigment was not accepted but minute printing also of after the gentle placement for three months which sees the distributed stability of a pigment, and a thermal cycling test was completed favorably.

[0035] (Example 3 of comparison) Although it replaced with the pigment of an example 2 and the mean particle diameter manufactured ink by the same method as an example 2 using the yellow pigment pigment yellow 109 which is 1.0 micrometers, sedimentation of a pigment was accepted by the gentle placement on the 1st, and sedimentation advanced after that. Although it returned to the uniform distribution state by stirring, when put, sedimentation of a pigment took place again.

[0036] (Example 4 of comparison) Although ink was manufactured by the same method as an example 2, using the polyoxyethylene nonylphenyl ether (tradename : noy gene EA- 170, Dai-Ichi



Kogyo Seiyaku make) as a dispersant replaced with the dispersant of an example 2, condensation of a pigment took place by gentle placement or the thermal cycling test, and favorable printing in this ink was not completed.

[0037] (Example 3) The mean particle diameter manufactured the yellow pigment pigment yellow 128 which is 0.2 micrometers, carried out distributed processing of the 50 sections, the polyoxyethylene nonylphenyl ethereal-sulfate ester salt (tradename : high tenor N-08, Dai-Ichi Kogyo Seiyaku make) 10 section which is a dispersant and the diethylene-glycol 20 section, the water 160 section, and the antiseptics (tradename : pro KUSERU GXL, product made from ICI) 2 section with the ball mill, and obtained the dispersion liquid of a yellow pigment. After adding the glycerol 150 section, the diethylene-glycol 80 section, the aqueous ammonia 2 section, and the water 526 section to these dispersion liquid and carrying out mixed stirring, it applied to centrifugal separation, the big and rough particle was removed, and the yellow jet ink whose pigment concentration is 5.0% was obtained. The 8th class and the pigment particle in ink are maintaining the original mean particle diameter, and minute printing of the lightfastness of ink in the paper was favorably completed with the ink jet printer. Condensation of a pigment was not accepted but minute printing also of after the gentle placement for three months which sees the distributed stability of a pigment, and a thermal cycling test was completed favorably.

[0038] (Example 5 of comparison) Although it replaced with the pigment of an example 3 and the mean particle diameter manufactured ink by the same method as an example 3 using the yellow pigment BIGUMENTOI yellow 128 which is 1.0 micrometers, sedimentation of a pigment was accepted by the gentle placement on the 1st, and sedimentation advanced after that. Although it returned to the uniform distribution state by stirring, when put, sedimentation of a pigment took place again.

[0039] (Example 6 of comparison) Although ink was manufactured by the same method as an example 3, using a naphthalenesulfonic acid formalin condensate (tradename : DEMORUN, Kao make) as a dispersant replaced with the dispersant of an example 3, condensation of a pigment took place by gentle placement or the thermal cycling test, and favorable printing in this ink was not completed.

[0040] (Example 4) The mean particle diameter manufactured the yellow pigment pigment yellow 128 which is 0.2 micrometers, carried out distributed processing of the 50 sections, the polyoxyethylene lauryl ether phosphoric ester (tradename : ply surfboard A208B, Dai-Ichi Kogyo Seiyaku make) 10 section which is a dispersant and the diethylene-glycol 20 section, the water 160 section, and the antiseptics (tradename : pro KUSERU GXL, product made from ICI) 2 section with the ball mill, and obtained the dispersion liquid of a yellow pigment. After adding the glycerol 150 section, the diethylene-glycol 80 section, the aqueous ammonia 2 section, and the water 526 section to these dispersion liquid and carrying out mixed stirring, it applied to centrifugal separation, the big and rough particle was removed, and the yellow jet ink whose pigment concentration is 5.0% was obtained. The 8th class and the pigment particle in ink are maintaining the original mean particle diameter, and minute printing of the lightfastness of ink in the paper was favorably completed with the ink jet printer. Condensation of a pigment was not accepted but minute printing also of after the gentle placement for three months which sees the distributed stability of a pigment, and a thermal cycling test was completed favorably.

[0041] (Example 9 of comparison) Although it replaced with the pigment of an example 4 and the mean particle diameter manufactured ink by the same method as an example 4 using the yellow pigment pigment yellow 128 which is 1.0 micrometers, sedimentation of a pigment was accepted by the gentle placement on the 1st, and sedimentation advanced after that. Although it returned to the uniform distribution state by stirring, when put, sedimentation of a pigment took place again.

[0042] (Example 10 of comparison) Although ink was manufactured by the same method as an example 4, using a styrene acrylic copolymer ammonium salt (tradename : the JON krill 62, the product made from Johnson polymer) as a dispersant replaced with the dispersant of an example 4, condensation of a pigment took place by gentle placement or the thermal cycling test, and favorable printing in this ink was not completed.

[0043]

[Effect of the Invention] In using the desirable yellow pigment of lightfastness and a color tone for this invention, it is choosing and combining the kind of the kind and particle diameter of a pigment, and dispersant, and made realizable the ink for ink jet printers distributed uniformly and stably.

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**TECHNICAL FIELD**

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[Industrial Application] The ink for ink jet printers is the field of the invention of this invention.

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**PRIOR ART**

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[Description of the Prior Art] The ink for ink jet printers using a color (following jet ink and abbreviated name) has a difficulty in lightfastness or water resistance, although printed matter is minute and is a clear color. If a pigment is used instead of a color, although it excels in lightfastness or water resistance, reservation of a definition, visibility, and distributed stability is difficult. Various improvement efforts, such as selection, atomization, stable decentralization, etc. of the pigment of a clear color, are performed with light-proof [ quantity ] and quantity water resistance, and the result of improvement has become accepting in black, red, and blue. However, it is in a state with a still inadequate yellow pigment. In the point of the microsome of light-proof [ quantity ] and quantity water resistance which is the basic requirements of the pigment for jet ink, the yellow pigment is inferior to other black, red, and blue pigment. In color printing, since neutral colors are combination of a fundamental color, if only yellow is inferior, minute clear printing will be difficult and color tone change will be accepted by aging. Such stable distribution becomes difficult that a pigment is atomized. If stable differential powder is not made, it condenses, and turns big and rough, nozzle plugging of a printer happens, and a pigment particle stops making the business as jet ink. Furthermore, stable distribution in jet ink with required being low viscosity is difficult. The jet ink of a yellow pigment is in a still dissatisfied state by such order.

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] In using the desirable yellow pigment of lightfastness and a color tone for this invention, it is choosing and combining the kind of the kind and particle diameter of a pigment, and dispersant, and made realizable the ink for ink jet printers distributed uniformly and stably.

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[Translation done.]

**\* NOTICES \***

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] this invention is excellent in light-fast water resistance, and let it be a technical problem to develop the jet ink of the yellow pigment currently distributed uniformly [ the pigment of a super-particle and a clear color ] in a distributed medium, and stably.

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[Translation done.]

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**MEANS**

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[Means for Solving the Problem] While this invention is excellent in the light-fast water resistance suitable for jet ink and chooses the pigment of a super-particle and a clear color, it chooses the dispersant in which is made to distribute uniformly and stably and it deals into a distributed medium, finds out the optimal composition out of both combination further, and expects technical-problem solution of the jet ink of a yellow pigment.

[0005] A use field is expanding an ink jet printer on many aspects of affairs of large-scale industrial activity from an individual life. If there is the so-called ink of a fundamental color, and the three primary colors and four black colors, by changing the discharge quantity of the ink from the nozzle of each color, the rate of a compounding ratio of ink will change and the color of hope will be acquired. The discharge quantity of each nozzle is controlled by KOMPITA. Multicolored printing is possible at a stretch at the print head which is the aggregate of a detailed nozzle. This enables high-speed printing or high efficiency printing. Moreover, easy alteration, i.e., the alteration of the main part of a printing machine, of expanding the movable range of a print head is made into the minimum, and it can respond also to large area printing. It is also predominant to use the ink of the drainage system which there is not or can be made into the minimum which is environmental pollution.

[0006] It is each color, and the color of a clear color is already developed, practical use is widely presented with it, and jet ink is also used. Since a color is used in solution, the homogeneity of concentration is ideal. Therefore, minute printing on the level which can reach the machine precision of a printing machine is possible. However, a color molecule has the inadequate resistance over the chemical of light, oxygen, water, or others, and the fault which deteriorates and fades with time is under those irradiation / contact. That is, the so-called endurance of ink or printed matter is dissatisfied.

[0007] On the other hand, although excelled in endurance like point \*\*, clear \*\*\*\* of a pigment is dissatisfied, since it is insoluble in water, use by the dispersed system is not avoided but it has various difficulties. Although a more desirable amorphous pigment with few [ very small moreover ] crystal ratios should have [ clear \*\*\*\* ] expensive crystal grain, manufacture is difficult, it belongs to the field of advanced know-how, and acquisition in a commercial scene is unexpectedly as difficult as high cost conjointly.

[0008] It is the universal demand to ink for minute printing to be possible. Although the super-atomization of a pigment is required, neither by the kind of pigment, nor its process, difficulty does not exist in atomization and it can necessarily super-atomize with any pigments. Even if a big and rough particle causes nozzle plugging and passes a nozzle, it is a serious disturbance factor of minute printing.

[0009] Since a pigment is un-water-soluble, as drainage system ink, it is a dispersed system. It is necessary to make stability distribute a very fine particle for a long period of time, while it has been detailed. It is easy to form condensation and a big and rough particle, so that a particulate material is detailed, and uniform and stable distribution becomes difficult. Moreover, in an ink jet, since ink is required to be low viscosity, as compared with the ink in other print processes which are high viscosity, the distribution exists under a much more difficult condition.

[0010] Although the endurance of a pigment is in desirable level generally, a difference has it by

molecular species. It is a problem whether lightfastness is secured or not, although water resistance etc. is enough and it is satisfactory as jet ink. When the dark color coloring paper in various yellow pigments compared lightfastness, the result of the 1st table was obtained. The lightfastness of front Naka is evaluation to the 8th best class from the 1st class with the worst change in color by exposure. The molecular species of a pigment is the classification by a pigment-content child's basic skeletal structure, and the same skeletal structure also indicated the case of a substituent or a substitution position where it differed. Light-fast level's differing, when molecular species's differs from the pigment of the same yellow system, and the molecular species of a same system of lightfastness being different are also clear if a substituent differs from a substitution position.

第1表：顔料の耐光性

顔料分子種	顔料 (C. I. 番号)	耐光性(級)
フラバントロン系	ピグメントイエロー24	5
モノアゾ系	ピグメントイエロー73	7
	ピグメントイエロー75	6
ジスアゾ系	ピグメントイエロー12	5
	ピグメントイエロー16	7
	ピグメントイエロー55	6
縮合アゾ系	ピグメントイエロー93	7
	ピグメントイエロー128	8
イソインドリノン系	ピグメントイエロー109	8
	ピグメントイエロー110	8
アントラキノン系	ピグメントイエロー99	8
	ピグメントイエロー108	8

[0011] Although it changes with exposure times etc. in the wavelength and the on-the-strength pan of an environmental condition and exposure light with which printed matter encounters, when the dissatisfaction in color system jet ink is canceled and the level of the lightfastness required of the yellow pigment for jet ink takes the lightfastness of the pigment of other colors into consideration, it is the 8th class desirably the 7th more than class. Both the lightfastness of the pigment red 122 of the PIKUMENTO blue 15:3 incidentally used often as blue pigment with another color pigment, for example or red pigments is the 8th class, and the number of lightfastness of black carbon black is also eight.

[0012] Only by the endurance which makes lightfastness the start being excellent, the pigment for jet ink is dissatisfied. It is important as an ultrafine particle to distribute uniformly and stably in ink so that printer nozzle plugging moreover may not be started so that minute printing may be possible.

[0013] Since the primary non-fixed form particle in the state where the overly detailed single crystal was combined with the amorphous object is an aggregated particle which carried out condensation combination further, the pigment with which a pigment is actually manufactured although the stable crystal structure changes with kinds of the molecule is a non-fixed form particle. With reaction conditions of pigment composition, an aggregated particle may condense the size of a particle further according to subsequent ejection conditions again, and it changes variously. If it takes out especially and stabilization, color tone regulation, etc. of heat treatment and other pigments are sometimes processed, condensation will progress in many cases. Therefore, the obtained pigment carries out pulverization atomization of this, and usually considers as the pigment for jet ink. The particle diameter of a pigment is measured with for example, laser diffraction or a scanning electron microscope. The diameter of a printer nozzle and especially the mean particle diameter of the demand of minute printing to a pigment have desirable 1 micrometer or less 5 micrometers or less.

[0014] Since intermolecular force changes with pigment molecular species, the difficulty of



atomization changes with kinds of pigment. Although neither the condensation azo system pigment nor the isoindolinone system pigment was necessarily easy and ultrafine-particle-izing was possible when this invention persons considered ultrafine particle-ization which goes back to a pigment composition reaction for example, ultrafine particle-ization should be satisfied [ with the metal-containing pigment of an anthraquinone system or others ] of-ization was not completed.

[0015] Fundamentally, the color tone of a yellow pigment becomes settled by molecular species, and changes with molecular species. Color tones differ delicately on manufacture conditions also with the same pigment. Even if it calls it yellow, the yellow which redness cut, the yellow which green cut are various. Although it is desirable that it is a clear color, simultaneously with it, the quality of neutral-colors tone coloring is asked by preparation with other primary colors. In a yellow pigment, the Color Index number pigment yellow 109 of an isoindolinone system or the Color Index number pigment yellow 128 of a condensation azo system is suitable also not only from lightfastness but this viewpoint.

[0016] In the yellow jet ink of this invention, a dispersion-medium object is the mixed liquor of water or water, and the water-soluble organic solvent. Although it is also possible to make uniform and stable jet ink from use of only water, it is the purpose which prevents improvement in the dispersion power force, and the blinding of the nozzle by dryness, and addition is indispensable in the water-soluble organic solvent little as a moisturizer.

[0017] If the water-soluble organic solvent in this invention is an amount [ at least ] fewer than water, it is an organic solvent which may be dissolved at water and an arbitrary rate. as the example — ethylene glycol, a diethylene glycol, and a propylene glycol — glycol ethers, such as alkanolamines, such as polyhydric-alcohol [ , such as the polyethylene glycol or polypropylene glycol of low molecular weight, and a glycerol, ], monoethanolamine, diethanolamine, N, and N-dimethylethanolamine and a morpholine, an ethylene glycol monomethyl ether, an ethylene glycol wood ether, the diethylene-glycol monomethyl ether, and tripropylene glycol monomethyl ether, are mentioned comparatively Volatility is low in these, and the way is more desirable although most odors cannot be found.

[0018] Generally, use of a dispersant is indispensable in order to make the dispersion-medium object of a drainage system distribute a pigment. Various kinds of dispersants are proposed from the former, and they are divided roughly into an anion activator, Nonion activator, cation activator, amphoteric activator, and macromolecule system dispersant. As an anion activator, a fatty-acid salt, alkylbenzene sulfonates, an alkyl-sulfuric-acid ester salt, alkyl phosphate, the alkyl sulfo succinate, a polyoxyethylene-alkyl-ether sulfate salt, polyoxyethylene alkyl ether phosphate, a naphthalene sulfonic-acid formalin condensation product, alpha-olefin sulfonate, etc. are the example. As an example of a Nonion activator, polyoxyethylene alkyl ether, polyoxyethylene alkyl aryl ether, polyoxyethylene alkylamine, oxyethylene / oxypropylene block copolymer, a sorbitan fatty acid ester, polyoxyethylene sorbitol fatty acid ester, polyoxyethylene fatty acid ester, a glycerine fatty acid ester, etc. are mentioned. As an example of a cation activator and an amphoteric activator, alkylamines, quaternary ammonium salts, alkyl betaines, and AMINOKI sides are mentioned. As a macromolecule system dispersant, a polyacrylic acid, styrene / acrylic-acid copolymer, styrene / maleic-anhydride copolymer, styrene / methacrylic-acid copolymer, styrene / acrylic acid / methacrylic-acid copolymer, styrene / maleic anhydrides / methacrylic-acid copolymers, or these salts are mentioned.

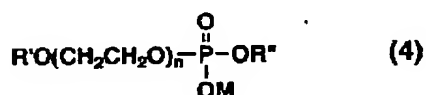
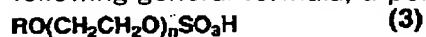
[0019] this invention persons — the original mean-particle-diameter 1.0–0.6micrometer pigment yellow 109 — said — the result which should be satisfied was not obtained although the various above-mentioned dispersants were comprehensively examined in making a drainage system medium distribute 128 Although the case where the distribution between short days was securable was accepted by the kind and the amount of the dispersant used, the distributed state stable to a long period of time was not securable. The dispersant applicable to this was a polyoxyethylene alkyl or an alkylphenyl ethereal-sulfate ester salt, a BORIOKISHI ethylene alkyl, or alkyl aryl ether phosphate. However, distribution between short days was not completed in the dispersant of the other varieties, either.

[0020] this invention persons — the pigment yellow 109 — said — as a result of pursuing

distribution of 128 further, stable distribution found out the bird clapper possible against the common idea that distribution becomes difficult, by super-atomizing a pigment to 0.2 micrometers or less of mean particle diameters in this case, and the pigment reached this invention, so that it was made detailed Although the reason is not yet clear, while the surface energy of a pigment increases by atomization and it becomes easy to condense The Brownian motion of a pigment particle becoming active and condensing by super-atomization, also sets being barred and a deer about the pigment of this invention, and the combination of a dispersion-medium object. Only a polyoxyethylene alkyl or an alkylphenyl ethereal-sulfate ester salt, a polyoxyethylene alkyl, or alkyl aryl ether phosphate acts effectively as a dispersant. The energy balance of a dispersed system can take a state advantageous to distribution, and is considered that the state in which stable distribution is possible is realized. The conditions which can be distributed stable were not able to be found out in the activators or macromolecule system dispersants other than the above.

[0021] the yellow pigment pigment yellow 109 which is the important requirements for composition of the above thing to this invention -- said -- the mean particle diameter of 128 is 0.2 micrometers or less Although stable prolonged distribution is comparatively possible even for about 0.5 micrometers even of mean particle diameters, there is misgiving practically. Stable distribution of a long period of time [ be / 0.2 micrometers or less / a mean particle diameter ] is possible. Although 0% of the content of the big and rough particle to which a particle diameter exceeds 1 micrometer is desirable, if it is 1 micrometer or less of maximum droplet sizes, about several% of existence is permitted.

[0022] The dispersant which are other important requirements for composition in this invention is the polyoxyethylene alkyl or alkylphenyl ethereal-sulfate ester salt (3) expressed with the following general formula, a polyoxyethylene alkyl, or alkyl aryl ether phosphate (4).



however, R -- an or more 4 carbon number [ or less 20 ] alkyl or alkylphenyl, and R' -- an alkyl or alkyl aryl, and R'' -- H or R (CH<sub>2</sub>CH<sub>2</sub>O) -- four or more positive numbers [ 100 or less ] and M to which n and n express the average degree of polymerization of an oxyethylene machine are bases, such as ammonium, an amine, or alkali metal

[0023] The alkyl group of a dispersant is a straight chain or an or more 4 carbon number [ or less 20 ] branched alkyl group, and an octyl, a nonyl, a dodecyl, especially a hexadecyl machine, etc. are desirable. The alkylphenyl machine of a dispersant is or more 4 carbon number [ which has a straight chain or the branched alkyl group as a substituent / or less 20 ] alkylphenyl, and an octyl phenyl, a nonylphenyl, especially a dodecyl phenyl group, etc. are desirable. It is the positive number not more than more than average-degree-of-polymerization n4 100 of an oxyethylene machine, and 50 especially or less [ 5 or more ] are desirable. Especially an amine is desirable although Base M is ammonium, an amine, or alkali metal. the time of the dispersant of this invention filling all the above conventions -- for the first time -- the pigment yellow 109 -- said -- it functions as a dispersant of 128 Although the dispersant of varieties was proposed for pigments, when the kind and character of a pigment were specified, it became clear that a suitable dispersant will not be found easily but will be localized to a certain narrow range.

[0024] The pigment chosen as mentioned above, a dispersant, water, and a hydrophilic solvent are used for a compounding ratio, choosing so that many request properties of ink, such as the distributed stability of a pigment and viscosity of ink, may be satisfied.

[0025] Although which concentration is sufficient as long as the operating rate of the pigment used in the jet ink of this invention is concentration which gives sufficient coloring concentration for the recorded body The rate which generally occupies 1 to 10 % of the weight in an ink constituent from various viewpoints, such as a stable operation of a printer nozzle and the preservation stability of ink, is desirable.

[0026] Although the amount of the dispersant used in the jet ink of this invention changes also with the kind of pigment, grain size, or request viscosity of jet ink and cannot generally be specified, it is desirable to use it at a rate of the 10 to 100 weight section generally to the pigment 100 weight section.

[0027] Although the mixed stock of water or water, and a hydrophilic solvent is used for the solvent object in the jet ink of this invention, as for the operating rate of the hydrophilic solvent in a mixed stock, it is desirable that they are below the 100 weight sections generally to the water 100 weight section.

[0028] It is possible to add additives of \*\*, such as the additive which is the field concerned and is already known, for example, antiseptics etc., by this invention if needed furthermore. Since a dispersant is an anion system, in order to make it stability especially, it is necessary to make it about 9 by addition of pH regulator.

[0029] The jet ink of this invention consists of an above-mentioned constituent and the above-mentioned blending ratio of coal, and various kinds of methods can be used for it in this manufacture. For example, after blending the various above-mentioned components and carrying out mixed grinding of the pigment for this conventionally by well-known dispersers, such as a ball mill, a Sand-grinder mill, a speed line mill, and a roll mill, the physical-properties value of concentration, grain size, and others can be adjusted, a big and rough particle can be removed by filtration, centrifugal separation, etc., and ink can be obtained.

[0030] Hereafter, an example is given and explained about this invention. In addition, the section is the weight section in a sentence. The lightfastness of a pigment applied ink in the paper, and exposed and judged it in xenon fade meter according to JISK5701. The grain size and particle size distribution of a pigment diluted ink with the liquid of a pigment to which a distributed change of state is not carried out, and measured it in the laser diffraction formula particle-size-distribution measuring device. The distributed stability of the pigment in ink measured change of the particle size distribution after 7 cycle \*\*\*\*\*, and judged the thermal cycling test which puts separately change of particle size distribution in the meantime, and ink at -20 degrees C by 60 degrees C for 12 hours for 12 hours after putting ink for three months at a room temperature.

[0031] (Example 1) The mean particle diameter manufactured the yellow pigment pigment yellow 109 which is 0.2 micrometers, carried out distributed processing of the 50 sections, the polyoxyethylene oleyl ethereal-sulfate ester salt (tradename : high tenor 18E, Dai-Ichi Kogyo Seiyaku make) 10 section which is a dispersant and the diethylene-glycol 20 section, the water 160 section, and the antiseptics (tradename : pro KUSERU GXL, product made from ICI) 2 section with the ball mill, and obtained the dispersion liquid of a yellow pigment. After adding the glycerol 150 section, the diethylene-glycol 80 section, the monoethanolamine 2 section, and the water 526 section to these dispersion liquid and carrying out mixed stirring, it applied to centrifugal separation, the big and rough particle was removed, and the yellow jet ink whose pigment concentration is 5.0% was obtained. The 8th class and the pigment particle in ink are maintaining the original mean particle diameter, and minute printing of the lightfastness of ink in the paper was favorably completed with the ink jet printer. Condensation of a pigment was not accepted but minute printing also of after the gentle placement for three months which sees the distributed stability of a pigment, and a thermal cycling test was completed favorably. In addition, both the lightfastness of the neutral colors which carried out equivalent mixture of this yellow ink, the ink of the blue-pigment PIKUMENTO blue 15:3, or the ink of the red-pigments pigment red 122 was the 8th class.

[0032] (Example 1 of comparison) Although it replaced with the pigment of an example 1 and the mean particle diameter manufactured ink by the same method as an example 1 using the yellow pigment pigment yellow 109 which is 1.0 micrometers, sedimentation of a pigment was accepted by the gentle placement on the 1st, and sedimentation advanced after that. Although it returned to the uniform distribution state by stirring, when put, sedimentation of a pigment took place again.

[0033] (Example 2 of comparison) Although ink was manufactured by the same method as an example 1, using a sorbitan oleate (tradename : SORUGEN 40, Dai-Ichi Kogyo Seiyaku make) as a dispersant replaced with the dispersant of an example 1, condensation of a pigment took place

by gentle placement or the thermal cycling test, and favorable printing in this ink was not completed.

[0034] (Example 2) The mean particle diameter manufactured the yellow pigment pigment yellow 109 which is 0.1 micrometers, carried out distributed processing of the 50 sections, the polyoxyethylene nonylphenyl ether phosphoric ester (tradename : ply surfboard A212E, Dai-Ichi Kogyo Seiyaku make) 10 section which is a dispersant and the diethylene-glycol 20 section, the water 160 section, and the antiseptics (tradename : pro KUSERU GXL, product made from ICI) 2 section with the ball mill, and obtained the dispersion liquid of a yellow pigment. After adding the glycerol 150 section, the diethylene-glycol 80 section, the diethanolamine 2 section, and the water 526 section to these dispersion liquid and carrying out mixed stirring, it applied to centrifugal separation, the big and rough particle was removed, and the yellow jet ink whose pigment concentration is 5.0% was obtained. The 8th class and the pigment particle in ink are maintaining the original mean particle diameter, and minute printing of the lightfastness of ink in the paper was favorably completed with the ink jet printer. Condensation of a pigment was not accepted but minute printing also of after the gentle placement for three months which sees the distributed stability of a pigment, and a thermal cycling test was completed favorably.

[0035] (Example 3 of comparison) Although it replaced with the pigment of an example 2 and the mean particle diameter manufactured ink by the same method as an example 2 using the yellow pigment pigment yellow 109 which is 1.0 micrometers, sedimentation of a pigment was accepted by the gentle placement on the 1st, and sedimentation advanced after that. Although it returned to the uniform distribution state by stirring, when put, sedimentation of a pigment took place again.

[0036] (Example 4 of comparison) Although ink was manufactured by the same method as an example 2, using the polyoxyethylene nonylphenyl ether (tradename : noy gene EA- 170, Dai-Ichi Kogyo Seiyaku make) as a dispersant replaced with the dispersant of an example 2, condensation of a pigment took place by gentle placement or the thermal cycling test, and favorable printing in this ink was not completed.

[0037] (Example 3) The mean particle diameter manufactured the yellow pigment pigment yellow 128 which is 0.2 micrometers, carried out distributed processing of the 50 sections, the polyoxyethylene nonylphenyl ethereal-sulfate ester salt (tradename : high tenor N-08, Dai-Ichi Kogyo Seiyaku make) 10 section which is a dispersant and the diethylene-glycol 20 section, the water 160 section, and the antiseptics (tradename : pro KUSERU GXL, product made from ICI) 2 section with the ball mill, and obtained the dispersion liquid of a yellow pigment. After adding the glycerol 150 section, the diethylene-glycol 80 section, the aqueous ammonia 2 section, and the water 526 section to these dispersion liquid and carrying out mixed stirring, it applied to centrifugal separation, the big and rough particle was removed, and the yellow jet ink whose pigment concentration is 5.0% was obtained. The 8th class and the pigment particle in ink are maintaining the original mean particle diameter, and minute printing of the lightfastness of ink in the paper was favorably completed with the ink jet printer. Condensation of a pigment was not accepted but minute printing also of after the gentle placement for three months which sees the distributed stability of a pigment, and a thermal cycling test was completed favorably.

[0038] (Example 5 of comparison) Although it replaced with the pigment of an example 3 and the mean particle diameter manufactured ink by the same method as an example 3 using the yellow pigment BIGUMENTOI yellow 128 which is 1.0 micrometers, sedimentation of a pigment was accepted by the gentle placement on the 1st, and sedimentation advanced after that. Although it returned to the uniform distribution state by stirring, when put, sedimentation of a pigment took place again.

[0039] (Example 6 of comparison) Although ink was manufactured by the same method as an example 3, using a naphthalenesulfonic acid formalin condensate (tradename : DEMORUN, Kao make) as a dispersant replaced with the dispersant of an example 3, condensation of a pigment took place by gentle placement or the thermal cycling test, and favorable printing in this ink was not completed.

[0040] (Example 4) The mean particle diameter manufactured the yellow pigment pigment yellow 128 which is 0.2 micrometers, carried out distributed processing of the 50 sections, the

polyoxyethylene lauryl ether phosphoric ester (tradename : ply surfboard A208B, Dai-Ichi Kogyo Seiyaku make) 10 section which is a dispersant and the diethylene-glycol 20 section, the water 160 section, and the antiseptics (tradename : pro KUSERU GXL, product made from ICI) 2 section with the ball mill, and obtained the dispersion liquid of a yellow pigment. After adding the glycerol 150 section, the diethylene-glycol 80 section, the aqueous ammonia 2 section, and the water 526 section to these dispersion liquid and carrying out mixed stirring, it applied to centrifugal separation, the big and rough particle was removed, and the yellow jet ink whose pigment concentration is 5.0% was obtained. The 8th class and the pigment particle in ink are maintaining the original mean particle diameter, and minute printing of the lightfastness of ink in the paper was favorably completed with the ink jet printer. Condensation of a pigment was not accepted but minute printing also of after the gentle placement for three months which sees the distributed stability of a pigment, and a thermal cycling test was completed favorably.

[0041] (Example 9 of comparison) Although it replaced with the pigment of an example 4 and the mean particle diameter manufactured ink by the same method as an example 4 using the yellow pigment pigment yellow 128 which is 1.0 micrometers, sedimentation of a pigment was accepted by the gentle placement on the 1st, and sedimentation advanced after that. Although it returned to the uniform distribution state by stirring, when put, sedimentation of a pigment took place again.

[0042] (Example 10 of comparison) Although ink was manufactured by the same method as an example 4, using a styrene acrylic copolymer ammonium salt (tradename : the JON krill 62, the product made from Johnson polymer) as a dispersant replaced with the dispersant of an example 4, condensation of a pigment took place by gentle placement or the thermal cycling test, and favorable printing in this ink was not completed.

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[Translation done.]